

## The Derivative Function – Class Notes

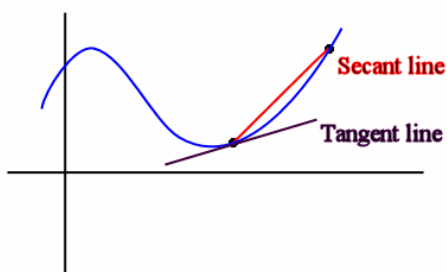
As mentioned in prior classes, calculus is the mathematical study of change.

### Defining the Derivative

- The derivative of a function is still a function.

Explain:

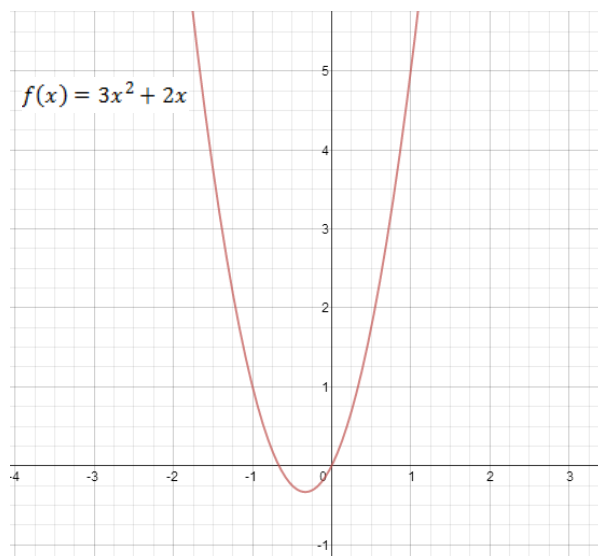
- The derivative of a function is a slope of a tangent line to the graph at any point on the graph.



By definition, the **derivative of  $f$  at the number  $a$**  is given by  $f'(a) = \lim_{h \rightarrow 0} \frac{f(a+h) - f(a)}{h}$ , provided that this limit exists.

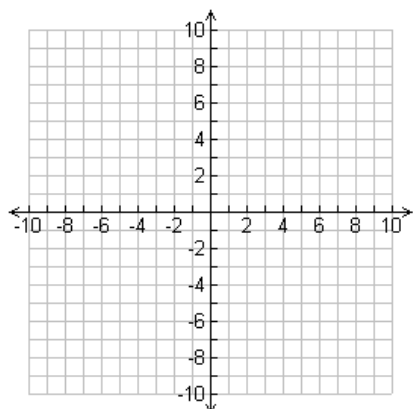
Derivative **notation**:

**Example:** Find the slope of a tangent line to the graph of  $f(x) = 3x^2 + 2x$  at  $x = 1$ .

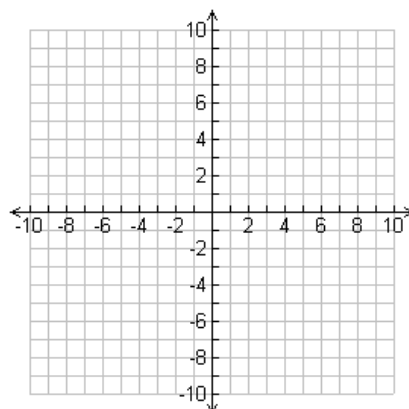


### The Existence of Derivatives

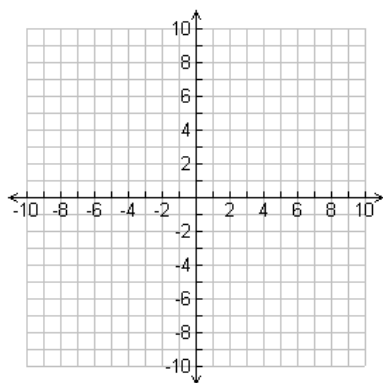
A derivative does not exist at a discontinuity.



A derivative does not exist at a corner/cusp.



A derivative does not exist at a vertical asymptote.



**Example:** An object moves in a straight line with its position at time  $t$  seconds given by  $s(t) = -t^2 + 8t$ , where  $s$  is measured in metres. Find the velocity when  $t=0$ ,  $t=4$ , and  $t=6$ .

**Elbow Partner Activity**

Find the derivative of  $f(x) = 6x^3 + 7x$  at  $x = 3$  and  $x = 5$ .